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Proposed Verification Regime for the K-Area Material Storage Facility at the Savannah River Site

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Abstract

In the decommissioning of the Rocky Flats Environmental Technology Site (RFETS), excess fissile material will be packaged and shipped to K-Area at the Savannah River Site (SRS) for storage. Shipments will commence in early 2000. It has been proposed that when this material is in storage at SRS, it be offered for international inspection under the scope of the Trilateral Initiative. Access to the material during storage at K-Area will be limited so all nondestructive assay and monitoring will involve just the shipping container and its enclosed contents. Therefore new approaches are being considered for verification and monitoring of this material under the Trilateral Initiative. This paper will identify the issues being addressed and will outline the preliminary verification and monitoring approach being discussed with the International Atomic Energy Agency.

Introduction

The K-Reactor at the Savannah River Site (SRS) was used for production of tritium and plutonium until operations ceased in 1988. By 1992, there was no provision for restart, so it was permanently closed as an operating reactor. Fuel was removed in the succeeding years and the K-Reactor was then used for storage of some material at Savannah River.

As the U.S. Department of Energy (DOE) was considering the process of the de-inventorying of Rocky Flats Environmental Technology Site (RFETS), the K-Reactor building was identified as a possible location for temporary storage of material from RFETS. In early 1997, the decision was made to modify the K-reactor building for storage of plutonium during an interim period of 10 or more years until disposition plans and facilities could be realized. The building is now referred to as the K-Areas Material Storage (KAMS) facility. Figure 1 is a plan view of the building showing the key elements of the receipt, measurement, and storage of the RFETS material.

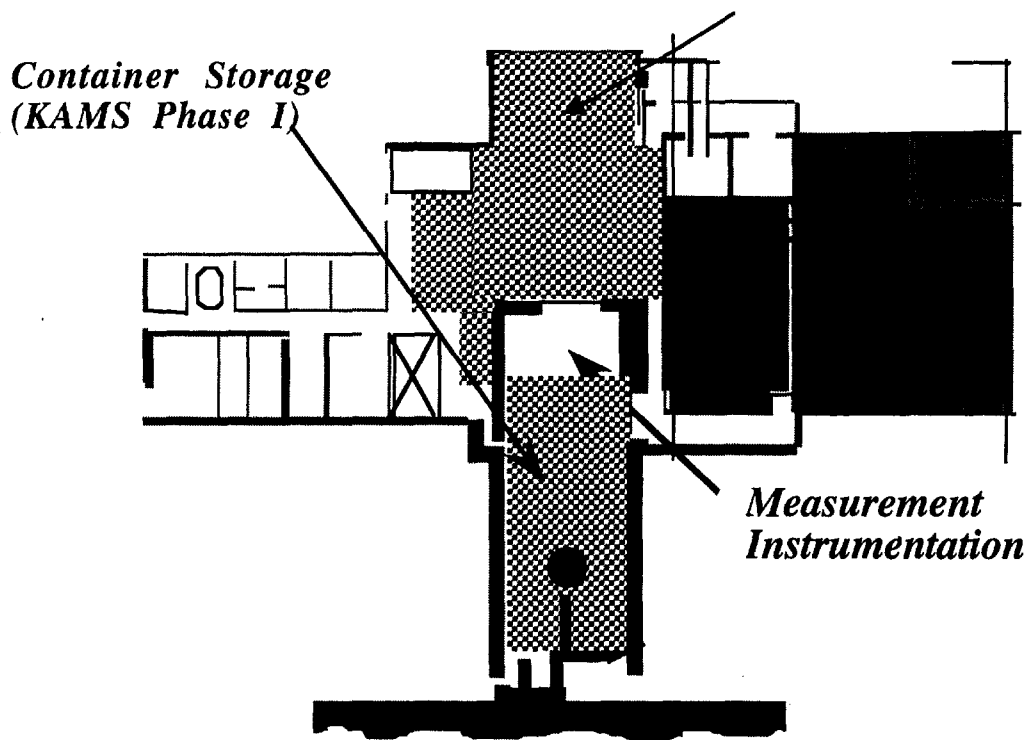


Fig. 1. Plan view of the K-reactor building showing the key elements of the receipt, measurement, and storage of the RFETS material

In September 1993, President Clinton offered to place nuclear material excess to national defense needs under international inspection. Under the Trilateral Initiative, the three parties—the United States, the Russian Federation (RF), and the International Atomic Energy Agency (IAEA)—are discussing the technical, legal, and financial issues raised by a new regime for IAEA inspection in nuclear weapon states. Development of an inspection regime under the Trilateral Initiative is consistent with U.S. and Russian obligations under articles I and VI of the Treaty on the Non-proliferation of Nuclear Weapons (NPT). Pending the resolution of these issues and consistent with U.S. policy, the material received from RFETS will be made available for inspection by the IAEA. This paper will focus on a safeguards/verification approach that could be implemented at KAMS until a verification regime under the Trilateral Initiative comes into force. (Currently there is a quantity of plutonium at RFETS that is under IAEA safeguards, and although that material will also be moved to KAMS following stabilization and repackaging, this paper will not address issues concerning that plutonium.)

The material destined for KAMS and IAEA verification is plutonium metal and oxide that has been cleaned or stabilized and packaged for storage in accordance with DOE standard 3013. These welded 3013 containers will then be placed in type 9975 shipping containers for transport to KAMS. The plutonium from RFETS will be stored at KAMS in the 9975 shipping containers. KAMS safety regulations will not permit opening shipping containers at KAMS. If any shipping container would need to be opened, it would first have to be relocated to an SRS facility that has an appropriate safety envelope.

Proposed Safeguards/Verification Approach

Technical meetings with IAEA personnel have been ongoing since June 1998 to develop possible approaches for verification at KAMS. KAMS is a storage facility only and the number of shipping containers containing RFETS material will be very large. There is a strong desire for a very efficient and effective system for both the domestic safeguards and international verification, and therefore efforts were focused on the joint use of inspection and monitoring equipment. Each 3013 container, when prepared at RFETS, will have a book value established using calorimetry. The 3013 container will then be packed in the 9975 shipping container and sent to KAMS.

Upon arrival at KAMS, RFETS tags and seals will be verified, the shipping container will be weighed, and nondestructive assay (NDA) will be used to verify the mass and isotopic composition of plutonium in the shipping container. However, because this NDA measurement will be on the shipping container rather than the 3013 storage container itself (as done at REFTS to establish a book value), the measurement uncertainty will be larger. NDA will consist of neutron multiplicity counting and a high-resolution gamma-ray isotopic measurement. SRS is in the process of procuring the NDA equipment, a neutron multiplicity counter (NMC), sized to accept the 9975 shipping container and a high-resolution gamma isotopic system (HRGS). An eventual goal expressed by the IAEA is unattended monitoring of receipts at K-Area.

Following the receipt, seal verification, and NDA measurements, the 9975 shipping containers will be sealed on pallets, five containers to a pallet, using a Radio Frequency Tamper Indicating Device (RFTID) developed by Sandia National Laboratories (SNL). The details of the RFTIDs and their use at KAMS and the steps required to maintain verification of the shipping containers are presented in the next paper in this session titled, "Update on Monitoring Technologies for International Safeguards and Fissile Material Verification," Douglas C. Smathers, et al. This RFTID is currently under review by the IAEA for approval for routine use.

To this point in planning for interim storage at the KAMS facility, the focus has been on the material, the packaging, and the process of getting it to KAMS for storage. The primary issues with implementation of IAEA inspections at KAMS revolve around the proposed IAEA verification approach. Because the goal of domestic and IAEA inspection is for maximum joint use of equipment, decisions relative to IAEA verification and domestic safeguards interrelate and can affect each other. Discussions and negotiations are in process on these details. The following are a summary of the key issues.

1. **Legal Framework:** While there is considerable effort by the Trilateral Initiative parties to conclude a Trilateral Agreement, such an agreement will most likely not be in place in early 2000 in time for initial receipt of plutonium at KAMS. Therefore the only legal framework between the U.S. and the IAEA for inspection is the Voluntary Offer Agreement (VOA). The VOA calls for the same safeguards procedures that are used in non-nuclear weapon States under Comprehensive Safeguards Agreements with a focus on mass accounting and verifying that a significant quantity of fissile material has not been diverted. Under the Trilateral Initiative, the goal of international verification would be to demonstrate that the material is irreversibly removed from nuclear weapons. The initial approach for the KAMS facility has not been decided. The U.S. and IAEA are considering implementing IAEA verification at KAMS under the scope of the Trilateral Initiative when an agreement is consummated.
2. **Joint Use of Equipment:** For cost savings, resource efficiencies, and dose minimization, three areas are being discussed for joint use. First is the NDA equipment. It is currently envisioned that there would be two outputs on the instruments sending the identical counter pulse data to the two systems. One tap would go to the domestic system using hardware and software of their choice, and the other tap would go to the IAEA for use with the hardware and software of their choice. The second type of potential joint-use equipment for KAMS is RFTIDs. SNL and the IAEA are

evaluating the authentication issues relative to their routine use by the IAEA. The third area for which joint use is under discussion is optical surveillance equipment. KAMS plans to install the NTvision system for surveillance of the storage areas, whereas the IAEA plans to use the DCM-14 camera system for surveillance of the measurement area where the RFTIDs are applied and removed. The shared use of some video surveillance data is still under discussion.

3. The basic concepts of the IAEA safeguards/verification approach include:
 - a. Each shipping container is an identifiable unit defined as an item.
 - b. Unattended monitoring of receipts is the primary option; attended verification will be a back-up option in case of failure of the unattended verification system. Short Notice Random Inspections (SNRIs) are anticipated.
 - c. Quantitative measurements will be made on each shipping container using NMC and HRGS.
 - d. After verification of the nuclear material by the IAEA, the shipping containers may be put under dual (redundant) containment/surveillance (C/S), thereby hopefully minimizing the need to re-verify the inventory at annual Physical Inventory Verifications (PIVs).
 - e. The dual C/S details are still under discussion; however, one option is to use the RFTIDs and optical surveillance.
 - f. The KAMS accounting and operating records will be provided to the IAEA.

The following are some of the key dates in preparing the KAMS facility.

Provisional IAEA verification developed	August 1998
Project construction modifications commenced	August 1998
Multiplicity and gamma counters ordered	April 1999
Cost estimate for addition of IAEA verification completed	May 1999
Review design & approach with IAEA	August 1999
Phase I construction completed	September 1999
NDA equipment arrival	November 1999
First material received	January 2000
Potential implementation of IAEA verification	May 2000

Summary

In summary, plutonium metal or oxide, stored in welded 3013 containers and shipped from RFETS in 9975 shipping containers, will be received at KAMS. The shipping containers will be received under DOE domestic safeguards criteria, then placed in interim storage pending disposition or long-term storage. In support of President Clinton's September 1993 offer to place nuclear material excess to national defense needs under international inspection, the U.S. would like to make this plutonium in its shipping containers available for IAEA verification and monitoring at the KAMS Facility under the scope of the Trilateral Initiative.